

CLAIMS

WE CLAIM:

1. A method for alternative routing of a connection between a source node and a destination node in a PNNI hierarchical network, the method comprising responding to a failed connection between said nodes due to a sole-access element of the network structure as seen by the source node, where a said sole-access element is an element which provides sole access to the destination node in said network structure, by:
  - selecting at least one non-sole-access element of the route used by the failed connection in said network structure;
  - identifying an alternative route for the connection in said network structure which does not utilize said at least one selected element; and
  - using the alternative route for establishment of the connection between said nodes.
2. A method according to claim 1 including checking whether said alternative route satisfies a set of predefined connection constraints, wherein said alternative route is used for establishment of the connection only if said constraints are satisfied.
3. A method according to claim 2 wherein said at least one element is a link of said network structure.
4. A method according to claim 3 wherein the step of selecting comprises selecting all non-sole-access links of the route used by said failed connection which are outside the PNNI peer group of the source node.
5. A method according to claim 3 wherein the step of selecting comprises selecting from the set of all non-sole-access links used by said failed connection which are outside the PNNI peer

1 group of the source node the link which is closest to a predetermined one of the source and  
2 destination nodes.

3 6. A method according to claim 5 including:

4 (a) if a successful connection is not established using the alternative route, selecting from  
5 said set of non-sole-access links the next closest link to the predetermined node, identifying a new  
6 alternative route for said connection which does not utilize said next closest link, and using the new  
7 alternative route for establishment of the connection between said nodes; and

8 (b) repeating step (a) for the new alternative route until all links in said set have been  
9 selected.

10 7. A method according to claim 6 including checking whether an identified new alternative  
11 route satisfies a set of predefined connection constraints, wherein the identified new alternative  
12 route is used for establishment of the connection only if said constraints are satisfied.

13 8. A method according to claim 6 wherein said new alternative route does not utilize any link  
14 of said set between said predetermined node and said next closest link.

15 9. A method according to claim 6 wherein said predetermined node is the destination node.

16 10. A method according to claim 4 wherein, if a successful connection is not established using  
17 said alternative route, the method includes:

18 (a) selecting from the set of all non-sole-access links used by said failed connection which  
19 are outside the PNNI peer group of the source node the link which is closest to a predetermined one  
20 of the source and destination nodes, identifying a new alternative route for the connection which  
21 does not utilize said closest link, and using the new alternative route for establishment of the  
22 connection between said nodes; and

1 (b) if a successful connection is not established using the new alternative route, selecting  
2 from said set of non-sole-access links the next closest link to the predetermined node, identifying a  
3 new alternative route for said connection which does not utilize said next closest link and using the  
4 new alternative route so identified for establishment of the connection between said nodes; and  
5 (c) repeating step (b) for the new alternative route so identified until all links in said set have  
6 been selected.

7 11. A method according to claim 10 including checking whether an identified new alternative  
8 route satisfies a set of predefined connection constraints, wherein the identified new alternative  
9 route is used for establishment of the connection only if said constraints are satisfied.

10 12. A method according to claim 10 wherein the new alternative route identified in step (b) does  
11 not utilize any link of said set between said predetermined node and said next closest link.

12 13. A method according to claim 10 wherein said predetermined node is the destination node.

13 14. Apparatus for alternative routing of a connection between a source node and a destination  
14 node in a PNNI hierarchical network, the apparatus comprising:  
15 memory for storing topology data, defining the network structure as seen by the source node,  
16 and route data indicative of the route in said network structure used for establishment of a  
17 connection between the source node and a destination node;  
18 control logic configured to respond to a failed connection between said nodes due to a  
19 sole-access element of the network structure as seen by the source node, where a said sole-access  
20 element is an element which provides sole access to the destination node in said network structure,  
21 by:  
22 selecting at least one non-sole-access element of the route used by the failed connection in  
23 accordance with said route data;

1 identifying from said topology data an alternative route for the connection which does not  
2 utilize said at least one selected element; and  
3 outputting the alternative route for establishment of the connection between said nodes.

4 15. Apparatus according to claim 14 wherein the control logic is configured to check whether  
5 the alternative route satisfies a set of predefined connection constraints, and to output the alternative  
6 route for establishment of the connection only if said constraints are satisfied.

7 16. Apparatus according to claim 15 wherein said at least one element is a link of said network  
8 structure.

9 17. Apparatus according to claim 16 wherein the control logic is configured to select all  
10 non-sole-access links of the route used by said failed connection which are outside the PNNI peer  
11 group of the source node when performing said selecting step.

12 18. Apparatus according to claim 16 wherein the control logic is configured to select from the  
13 set of all non-sole-access links used by the failed connection which are outside the PNNI peer group  
14 of the source node the link which is closest to a predetermined one of the source and destination  
15 nodes when performing said selecting step.

16 19. Apparatus according to claim 18 wherein the control logic is configured such that:

17 (a) if a successful connection is not established using the alternative route, the control logic  
18 selects from said set of non-sole-access links the next closest link to the predetermined node,  
19 identifies a new alternative route for said connection which does not utilize said next closest link,  
20 and outputs the new alternative route for establishment of the connection between said nodes; and

21 (b) the control logic repeats step (a) for the new alternative route until all links in said set  
22 have been selected.

1 20. Apparatus according to claim 19 wherein the control logic is configured to check whether  
2 an identified new alternative route satisfies a set of predefined connection constraints, and to output  
3 the identified new alternative route for establishment of the connection only if said constraints are  
4 satisfied.

5 21. Apparatus according to claim 19 wherein the new alternative route does not utilize any link  
6 of said set between said predetermined node and said next closest link.

7 22. Apparatus according to claim 19 wherein said predetermined node is the destination node.

8 23. Apparatus according to claim 17 wherein the control logic is configured such that, if a  
9 successful connection is not established using said alternative route:

10 (a) the control logic selects from the set of all non-sole-access links used by said failed  
11 connection which are outside the PNNI peer group of the source node the link which is closest to a  
12 predetermined one of the source and destination nodes, identifies a new alternative route for the  
13 connection which does not utilize said closest link, and outputs the new alternative route for  
14 establishment of the connection between said nodes; and

15 (b) if a successful connection is not established using the new alternative route, the control  
16 logic selects from said set of non-sole-access links the next closest link to the predetermined node,  
17 identifies a new alternative route for said connection which does not utilize said next closest link,  
18 and outputs the new alternative route so identified for establishment of the connection between said  
19 nodes; and

20 (c) the control logic repeats step (b) for the new alternative route so identified until all links  
21 in said set have been selected.

22 24. Apparatus according to claim 23 wherein the control logic is configured to check whether  
23 an identified new alternative route satisfies a set of predefined connection constraints, and to output

1 the identified new alternative route for establishment of the connection only if said constraints are  
2 satisfied.

3 25. Apparatus according to claim 23 wherein the new alternative route identified in step (b) does  
4 not utilize any link of said set between said predetermined node and said next closest link.

5 26. Apparatus according to claim 23 wherein said predetermined node is the destination node.

6 27. A source node of a PNNI hierarchical network, the source node having apparatus for  
7 alternative routing of a connection between that source node and a destination node in the network,  
8 said apparatus comprising:

9 memory for storing topology data, defining the network structure as seen by the source node,  
10 and route data indicative of the route in said network structure used for establishment of a  
11 connection between the source node and a destination node;

12 control logic configured to respond to a failed connection between said nodes due to a  
13 sole-access element of the network structure as seen by the source node, where a said sole-access  
14 element is an element which provides sole access to the destination node in said network structure,  
15 by:

16 selecting at least one non-sole-access element of the route used by the failed connection in  
17 accordance with said route data;

18 identifying from said topology data an alternative route for the connection which does not  
19 utilize said at least one selected element; and

20 outputting the alternative route for establishment of the connection between said nodes.

21 28. A route server for association with a peer group of nodes in a PNNI hierarchical network, the  
22 route server comprising apparatus for alternative routing of a connection between a source node in  
23 said peer group and a destination node in the network, said apparatus comprising:

1 memory for storing topology data, defining the network structure as seen by the source node,  
2 and route data indicative of the route in said network structure used for establishment of a  
3 connection between the source node and a destination node;

4 control logic configured to respond to a failed connection between said nodes due to a  
5 sole-access element of the network structure as seen by the source node, where a said sole-access  
6 element is an element which provides sole access to the destination node in said network structure,  
7 by:

8 selecting at least one non-sole-access element of the route used by the failed connection in  
9 accordance with said route data;

10 identifying from said topology data an alternative route for the connection which does not  
11 utilize said at least one selected element; and

12 outputting the alternative route for establishment of the connection between said nodes.

13 29. A PNNI hierarchical network comprising apparatus for alternative routing of a connection  
14 between a source node and a destination node in said network, the apparatus comprising:

15 memory for storing topology data, defining the network structure as seen by the source node,  
16 and route data indicative of the route in said network structure used for establishment of a  
17 connection between the source node and a destination node;

18 control logic configured to respond to a failed connection between said nodes due to a  
19 sole-access element of the network structure as seen by the source node, where a said sole-access  
20 element is an element which provides sole access to the destination node in said network structure,  
21 by:

22 selecting at least one non-sole-access element of the route used by the failed connection in  
23 accordance with said route data;

24 identifying from said topology data an alternative route for the connection which does not  
25 utilize said at least one selected element; and

26 outputting the alternative route for establishment of the connection between said nodes.

1 30. An article of manufacture comprising a computer usable medium having computer readable  
2 program code means embodied therein for causing alternative routing of a connection between a  
3 source node and a destination node in a PNNI hierarchical network, the computer readable program  
4 code means in said article of manufacture comprising computer readable program code means for  
5 causing a computer to effect the steps of claim 1.

6 31. A program storage device readable by machine, tangibly embodying a program of  
7 instructions executable by the machine to perform method steps for causing alternative routing of a  
8 connection between a source node and a destination node in a PNNI hierarchical network, said  
9 method steps comprising the steps of claim 1.

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